

# **FOREST STEWARDSHIP Report**

44Acres

Tax Parcels 16-004.01

Shellpot Creek Watershed

Arden Woods  
0 Sherwood Road  
Arden, DE 19810



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## TABLE OF CONTENTS

Location and General Woodlot Description .....	3
Landowners Objectives .....	3
Boundaries .....	2
Accessibility .....	4
Soils .....	4
Forest Types .....	5
Reconnaissance and Cruise Information Collected .....	5
General Cruise Information .....	5
Forest Management Recommendations (Stand Description) .....	6,8
Overstory Summary Table .....	6,8
Net Board-Foot Volume Table .....	7,9
Forest Management Summary .....	10
Stand Map .....	11
Boardfoot Volumes Map .....	12
Soils Map.....	13
Invasive Species .....	14-23
Glossary of Terms .....	24-25
Timber Sale Contracts .....	31-32
Preparing to Sell Forest Products .....	33

## **LOCATION AND GENERAL FOREST DESCRIPTION**

The Arden property, identified as New Castle County tax parcel # 16.004.00-001, consisting of 44 acres, of which 44 are forested acres. The property is located on the north and south side of Grubb-Harvey Road, in the Shellpot Creek Watershed, of New Castle County. (For details see Figure 1.)

## **LANDOWNERS OBJECTIVES**

The Arden community is interested in introducing a forest management program that will promote forest health while providing for secondary goals of wildlife and recreation.

The primary objective of this report is to present recommendations designed to help the community meet their goals. This plan will improve the quality of individual trees and develop the stocking of trees in the property that will adequately maintain site productivity. Growth through timber stand improvement (TSI) work will be concentrated around the better quality trees, where the greatest potential exists for optimizing benefits. Silvicultural techniques used on the stands will maximize the growth potential and help the trees reach large sawtimber and veneer quality logs when possible.

### **Stewardship Considerations**

#### **Aesthetics**

Aesthetics is a primary goal. The forest has been established for quite some time and it is families desire to maintain the property in a natural forested state.

#### **Threatened and endangered species; Cultural and historical resources**

According to available maps and information, no threatened or endangered species or cultural resources are located on this property.

#### **Forest health and protection**

Survey, detection, and monitoring of existing or potential forest health problems (e.g., insects, diseases, weather-related injury, etc.) will be accomplished through a co-operative effort between the Arden community and the DDA Forest Service. Periodic inspections will be conducted by the DDA Forest Service to augment landowner visits.

#### **Recreational opportunities**

Recreational opportunities are not a specific goal of this plan.

#### **Soil and water quality protection**

This is a major consideration in this plan and management activities will be recommended and conducted with this goal in mind.

#### Riparian and wetland protection and enhancement

Hydric soils, as listed on the hydric soil list of New Castle County, are found within the property boundaries. Management prescriptions will be made according to best management practices and will be sensitive to these areas.

#### Timber

Managing for forest products is the secondary goal of this plan.

#### Wildlife

Providing a variety of wildlife habitat areas is a secondary goal of this plan.

For Deer management in the Arden Woods DNREC should be contacted for assistance. The website address is: <https://dnrec.alpha.delaware.gov/fish-wildlife/hunting/deer-damage-assistance/>

### SOILS

The Arden property consists mainly of two soil types covering the property. Soils series of the property consist of, Talleyville-Montalto-Urban-(TdB) , Mount Lucas-Urban- (MzuB) and Delanco-Codorus-Hatboro-(DcB) in the creek bottoms. (See Figure 2.) Soil information was taken from the Web Soil Survey, New Castle County – USDA Soil Conservation Service.

The (TdB) component makes up 44 percent of the map unit. Slopes are 0 to 8 percent. This component is on terraces, piedmonts. The parent material consists of silty eolian deposits over clayey residuum weathered from igneous rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

The (MzuB) component makes up 32 percent of the map unit. Slopes are 0 to 8 percent. This component is on nearly level to moderately steep hillslopes, uplands. The parent material consists of colluvium derived from gabbro over residuum weathered from gabbro. Depth to a root restrictive layer, bedrock, lithic, is 48 to 99 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 21 inches during January, February, March, April, November, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

The (DcB), frequently flooded component makes up 23 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains, river valleys. The parent material consists of loamy alluvium derived from schist, unspecified. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is low. This soil is frequently flooded. It is frequently ponded. A seasonal zone of water saturation is at 3 inches during January, February, March, April, May, October, November, December. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 5w. This soil meets hydric criteria

## **BOUNDARIES**

Boundaries of the property are not marked. (See Figure 4.)

## **ACCESSIBILITY**

The property is on the north and south side of Grubb-Harvey Road approximately a mile west of I-95. A creek runs through a portions of stands 1 and 2. Equipment use is severely limited due to the geology and topography of the parcel.

## **SITE INDEX**

A site index is a term used by foresters to describe the site productivity for a certain tree species or group of species. The site indexes (curves) used in this plan is based on the height that a tree will grow on a particular soil in 50 years. If a tree grows 50 feet in 50 years, the site index is 50; if it grows 100 feet in the same amount of time, the site index is 100 and the larger the number the higher the site productivity. Generally, the Arden property has a site index of 85.

## **FOREST TYPES**

A pure forest stand is considered one in which 80% or more of the trees in the main canopy of the crown are of the same species. In a mixed stand, no species makes up more than 80% of the main crown canopy. Stand 1 of the Arden property is classified as an oak-hickory forest. Oak-hickory forests are dominated by oak species, including white, northern red, scarlet, chestnut, and black oaks and all hickory species. Stand 2 is classified as an Appalachian hardwood forest. Appalachian hardwoods are a variant of the northern hardwoods in which the northern hardwood species (American beech, sugar and red maple, and yellow birch) are supplemented by a strong proportion of yellow-poplar.\*\*\*

## **RECONNAISSANCE AND CRUISE INFORMATION COLLECTED**

The property was cruised as two stands each due to the homogeneous composition of the acreage. The timber was inventoried using a variable plot sampling method. Forty plots were established on the property. The plots were laid out in a general coverage plan, with approximately 264 feet between plots. At each plot, information was recorded about the present condition of the trees, species present, size, and harvesting possibilities.

The trees were divided into three classes, sawtimber, poletimber and saplings. Those placed in the sawtimber category were at least eleven inches in diameter breast high (D.B.H. = 4 2 feet above the average ground level) and relatively straight and free of defects for at least sixteen feet. Sawtimber volume is measured in board feet, with one board foot representing a board one foot square and one inch thick. Sawtimber volumes were calculated using the International 3" Log Scale. Trees less than eleven inches, but greater than five inches D.B.H., were placed in the poletimber class. These were measured in cords, with one cord being a pile of wood four feet high, four feet wide and eight feet long (128 cubic feet). All trees averaging less than 5" D.B.H. were recorded as saplings.

\*\*\* For forest type names and numbers, refer to *Forest Cover Types of the United States and*

Canada, Society of American Foresters, 1980.

## GENERAL WOODLAND DESCRIPTION

**Stand 1** 22 Acres

Average age: 150 years

Soils: DcB, TcB

Site Index: 85

### Stand Description

Stand one is an approximately 150 yr. old hardwood forest. The stands average size is in the large sawtimber size class with a medial stand diameter of 24.0 inches. The main overstory species, as percent of the basal area, are *Fagus grandifolia* (American beech) – 39%, *Lireodendron tulipifera* (Yellow poplar)-23%, *Quercus alba* (White oak species)-14%, *Acer rubrum* (Red maple)-6%, *Quercus sp.* (Red oak species)-6%, *Liquidambar styraciflua* (Sweetgum)-6%, *Carya sp.* (Hickory species)– 3%, *Nyssa sylvatica* (Blackgum) - 1%, and other species – 4%.

The relative density of the stand is 80% of the average maximum stocking expected in undisturbed tracts of similar size and species composition. This density is within the range for best individual tree growth. At this relative density, growth rate of the biggest trees is probably excellent, while growth of medium and smaller-sized trees is probably good. Total growing stock of the stand is at 124 sq. ft. of basal area per acre. The total net merchantable volume of wood in the stand, in terms of pulpwood and sawtimber, is 8 cords per acre and 14533board feet per acre\*. (See Table 1 & 1a). Six percent of the basal area is in poletimber and fourteen, twenty-four, and fifty-seven percent is in small, medium and large sawtimber size trees, respectively. A further discussion will be made in the Forest Management Summary section of this report.

Table 1.									
Overstory Summary									
Stand 1									
Species>	All Sp.	AB.	YP	WO	RM	RO	SG	H	Other
COMPOSITION-BA/Ac, % BA, Trees/Ac									
Total BA	124	48.0	29.0	18.0	7.5	7.0	7.0	5.5	2.0
Species%	100.0	38.6	23.3	14.5	6.0	5.6	5.6	4.4	2.0
# Trees	156	92.5	10.7	4.3	24.4	7.1	4.0	8.3	4.7
DIAMETERS, REL DENSITY - Inches, %									
MDL DIA	24.0	19.1	32.1	29.4	12.8	29.1	22.7	22.0	10.4
MRCH DIA	24.8	20.0	32.1	29.4	15.0	31.1	22.7	22.9	10.4
QUAD DIA	12.1	9.8	22.3	27.8	7.5	13.4	18.0	18.4	11.4
REL DEN%	79.7	38.5	8.0	13.1	5.2	6.0	3.5	3.8	1.5
BASAL AREA, (Sq. Ft./ Ac)/ SIZE CLASS									
SAPS	5.0	2.5	0.0	0.0	1.5	0.5	0.0	0.5	0.0
POLES	7.5	2.0	1.0	0.0	2.5	0.0	0.5	0.5	1.0
SM SAW	18.5	13.0	2.5	0.0	0.5	0.0	1.0	0.5	1.0
MD SAW	30.5	18.5	3.0	3.0	2.5	1.0	1.0	1.0	0.5
LG SAW	67.5	14.0	22.5	15.5	0.5	7.5	4.5	3.0	0.0
VOLUME ( Bd. Ft./ Ac)- International 1/4" LOG RULE									

<b>NET BD. FT.</b>	14533	4774	4224	2751	279	996	836	402	101

*\*International 1/4 Inch Rule (board feet 12" x 12" x 1")*

<b>Table 1a.</b>										
<b>Stand 1 NET BOARD FOOT VOLUME (SPECIES &amp; DIAMETER)</b>										
<b>INTERNATIONAL 1/4" LOG RULE--BD. FT./ ACRE</b>										
<b>Species&gt;</b>	<b>All Sp.</b>	<b>AB.</b>	<b>YP</b>	<b>RM</b>	<b>WO</b>	<b>RO</b>	<b>H</b>	<b>BG</b>	<b>Other</b>	
<b>Diameter</b>										
<b>12</b>	176	118	23	36	0	0	0	10	28	
<b>14</b>	328	256	47	0	0	0	10	0	0	
<b>16</b>	538	364	49	0	0	0	0	16	62	
<b>18</b>	1147	759	168	105	25	0	0	0	0	
<b>20</b>	1015	584	107	26	107	85	23	23	0	
<b>22</b>	916	751	0	56	109	0	36	23	0	
<b>24</b>	1311	734	0	57	247	62	0	0	0	
<b>26</b>	1340	410	241	0	169	0	0	0	0	
<b>28</b>	843	132	186	0	156	210	31	0	0	
<b>30</b>	2043	441	362	0	809	256	0	0	0	
<b>32</b>	934	87	304	0	367	78	0	0	0	
<b>34</b>	789	87	424	0	277	0	0	0	0	
<b>36</b>	1114	48	717	0	225	123	39	0	0	
<b>38</b>	572	0	390	0	182	0	0	0	0	
<b>40+</b>	1462	0	1203	0	76	183	0	0	0	
<b>SAPS</b>	0	0	0	0	0	0	0	0	0	
<b>POLES</b>	0	0	0	0	0	0	0	0	0	
<b>SM SAW</b>	1043	739	120	36	0	0	38	62	0	
<b>MD SAW</b>	3079	2094	275	186	241	85	67	39	0	
<b>LG SAW</b>	10411	1941	3829	57	2510	911	224	0	0	
<b>TOTAL</b>	14533	4774	4224	279	2751	996	329	101	0	

\*Estimates by Northeast Decision Model Stand Inventory Processor

**Stand 2** 15.0 Acres

Average age: 150 years

Soils: DcB, TcB

Site Index: 85

### Stand Description

Stand two is an approximately 150 year-old hardwood forest. The stand is considered a large sawtimber stand, with a medial stand diameter of 23.2 inches. The main overstory species, as percent of the basal area, are *Fagus grandifolia* (American beech)-47%, *Liriodendron tulipifera* (Yellow-poplar) – 20%, *Liquidambar styraciflua* (Sweetgum)-12 %, *Quercus alba* (white oak)-9%, *Acer rubrum* (red maple)-5%, *Carya sp.* (hickory)-3%, *Quercus rubra* (red oak sp.)-2%, *Nyssa sylvatica* (blackgum)-2%.

The relative density of the stand is 82% of the average maximum stocking expected in undisturbed tracts of similar size and species composition. This density is within the range for best individual tree growth. At this relative density, growth rate of the biggest trees is probably excellent, while growth of medium and smaller-sized trees is probably good. Total growing stock of the stand is at 129 sq. ft. of basal area per acre. The total net merchantable volume of wood in the stand, in terms of pulpwood and sawtimber, is 8.9 cords/ac and 15864 board feet per acre. (See Table 2 and 2a) Seven percent of the basal area is in poletimber and ten, twenty-nine, and fifty-one percent is in small, medium and large sawtimber size trees, respectively. A further discussion will be made in the Forest Management Summary section of this report.

Table 2a.									
Overstory Summary									
Stand 2									
Species>	All Sp.	AB	YP	SG	WO	RM	H	BG	RO
COMPOSITION-BA/Ac, % BA, Trees/Ac									
Total BA	129	60.0	26.0	15.0	12.0	6.5	3.5	2.5	2.0
Species%	100.0	46.5	20.2	11.6	9.3	5.0	2.7	1.9	1.6
# Trees	133.5	76.5	9.7	13.4	2.4	20.1	1.6	1.8	0.7
DIAMETERS, REL DENSITY - Inches, %									
MDL DIA	23.2	20.6	28.1	23.3	32.1	13.8	22.9	16.8	30.5
MRCH DIA	23.7	21.0	28.1	23.9	32.1	15.6	22.9	16.8	30.5
QUAD DIA	13.3	12.0	22.1	14.3	30.4	7.7	19.8	15.8	22.9
REL DEN%	82.1	47.2	7.4	7.7	8.7	4.4	2.6	1.4	1.7
BASAL AREA, (Sq. Ft./ Ac)/ SIZE CLASS									
SAPS	3.5	1.5	0.0	0.5	0.0	1.0	0.0	0.0	0.0
POLES	9.0	5.5	1.0	0.5	0.0	1.5	0.0	0.0	0.0
SM SAW	13.5	8.0	0.0	1.5	0.0	1.5	0.5	1.5	0.5
MD SAW	37.5	25.0	4.5	3.0	1.0	1.5	1.5	1.0	0.0
LG SAW	66.5	20.5	20.5	9.5	11.5	1.0	1.5	0.0	1.5
VOLUME (Bd. Ft./ Ac)- International 1/4" LOG RULE									
NET BD. FT.	15864	6571	4438	1640	1904	311	428	165	341



\**International 1/4 Inch Rule* (board feet 12" x 12" x 1")

	<b>Stand 2 NET BOARD FOOT VOLUME (SPECIES &amp; DIAMETER)</b>								
	<b>INTERNATIONAL 1/4" LOG RULE--BD. FT./ ACRE (AGS)</b>								
<b>Species&gt;</b>	<b>All Sp.</b>	<b>AB</b>	<b>YP</b>	<b>SG</b>	<b>WO</b>	<b>RM</b>	<b>H</b>	<b>RO</b>	<b>BG</b>
<b>Diameter</b>									
<b>12</b>	136	54	0	0	0	36	23	0	23
<b>14</b>	234	184	0	24	0	0	0	25	0
<b>16</b>	343	220	0	49	0	25	0	0	49
<b>18</b>	1036	620	116	181	0	79	0	0	38
<b>20</b>	1187	843	80	78	78	0	107	0	0
<b>22</b>	2032	1512	354	0	0	71	39	0	54
<b>24</b>	1729	1008	303	320	55	41	0	0	0
<b>26</b>	1505	400	598	336	0	0	169	0	0
<b>28</b>	1536	555	702	72	72	58	0	76	0
<b>30</b>	2014	659	381	448	462	0	0	0	0
<b>32</b>	1832	288	912	88	542	0	0	0	0
<b>34</b>	714	68	394	0	163	0	88	0	0
<b>36</b>	611	88	299	0	223	0	0	0	0
<b>38</b>	288	0	106	0	181	0	0	0	0
<b>40+</b>	665	69	189	42	124	0	0	239	0
<b>SAPS</b>	0	0	0	0	0	0	0	0	0
<b>POLES</b>	0	0	0	0	0	0	0	0	0
<b>SM SAW</b>	713	459	0	72	0	61	23	25	71
<b>MD SAW</b>	4255	2976	550	260	78	150	146	0	93
<b>LG SAW</b>	10895	3136	3888	1306	1826	99	258	316	0
<b>TOTAL</b>	15864	6571	4438	1640	1904	310	428	341	164

## FOREST MANAGEMENT RECOMMENDATIONS

The forest on the Arden property is in good condition. Stand 1 and 2 are considered a climax eastern hardwood forest. Principle timber species on the woodlot include American beech, yellow poplar, white oak, and red oak species. Red maple, blackgum, and hickory occur as associated species throughout the forest. The timber on the tract is in one size class –large sawtimber. No major fire, or insect problems were seen, but disease problems were detected during evaluation of the property. Bacterial leaf scorch (BLS) (Appendix C.) symptoms were seen most of the red oak species and there are standing dead and blow over BLS trees in both stands 1 & 2. The timber on the property had an overall quadratic mean diameter of 12.7 inches d.b.h.. The total standing volume of timber on the property was estimated to be 668,750 Bd. Ft.

**Stand 1** is in the northern portion of the Arden woods. (See Figure 4.) Only one size class is present (large saw) and is indicative of the understory's low diversity. Forests of this size should be developing a full suite of understory vegetation and accumulating some woody debris. Twenty-five percent of the stand has serious ground cover regeneration interference, mainly consisting of *Hedera helix* (English ivy) and *Pachysandra terminalis* (Pachysandra), plus the property has a high Cervidae (deer) population.

Ninety percent of the species composition is good for timber production. Yellow-poplar, red oak, and white oak constitute forty-seven percent of the total timber volume. There are areas of the stand that are being invaded with invasive species particularly stilt grasses, *Rubus phoenicolasius* (Wineberry), *Berberis thunbergii* (Japanese barberry), and *Lonicera spp.* (honeysuckle) (see Appendix B). In the inventory plots, and most of the forest floor on the property, there was patchy advanced regeneration in the plots, twenty percent having beech regeneration and twenty-five percent having oak or poplar regeneration. The percentage of beech is probably because beech is an allelopathic species which makes it hard for other species to regenerate under a beech overstory.

**Prescription:** No silvicultural treatment was requested at this time. Regeneration should be monitored to see if it is regenerating in preferred species or if a planting project is warranted. The stand should also be routinely monitored for any future invasive infestations.

**Stand 2** is in the southern portion of the Arden woods (See Figure 1.) One size class is dominant (large saw) in the stand. and there is low diversity in the understory. Twenty-eight percent of the stand has serious ground cover regeneration interference, mainly consisting of *Hedera helix* (English ivy) and plus the property has a high Cervidae (deer) population.

Ninety-two percent of the species composition is good for timber production. Yellow-poplar, red oak, and white oak constitute eighty-three percent of the total timber volume. In the inventory plots, and most of the forest floor on the property, there was patchy advanced regeneration in the plots, forty percent having beech regeneration and thirty percent having oak or poplar regeneration. This is probably because beech is an allelopathic species and a high Cervidae (deer) population in the area.

**Prescription:** No silvicultural treatment was requested at this time. As in Stand 1 the regeneration should be monitored to see if it is regenerating in preferred species or if a planting project is warranted. The stand should also be routinely monitored for any future invasive infestations.





## APPENDIX A MAPS

Figure 1. --Stand map.

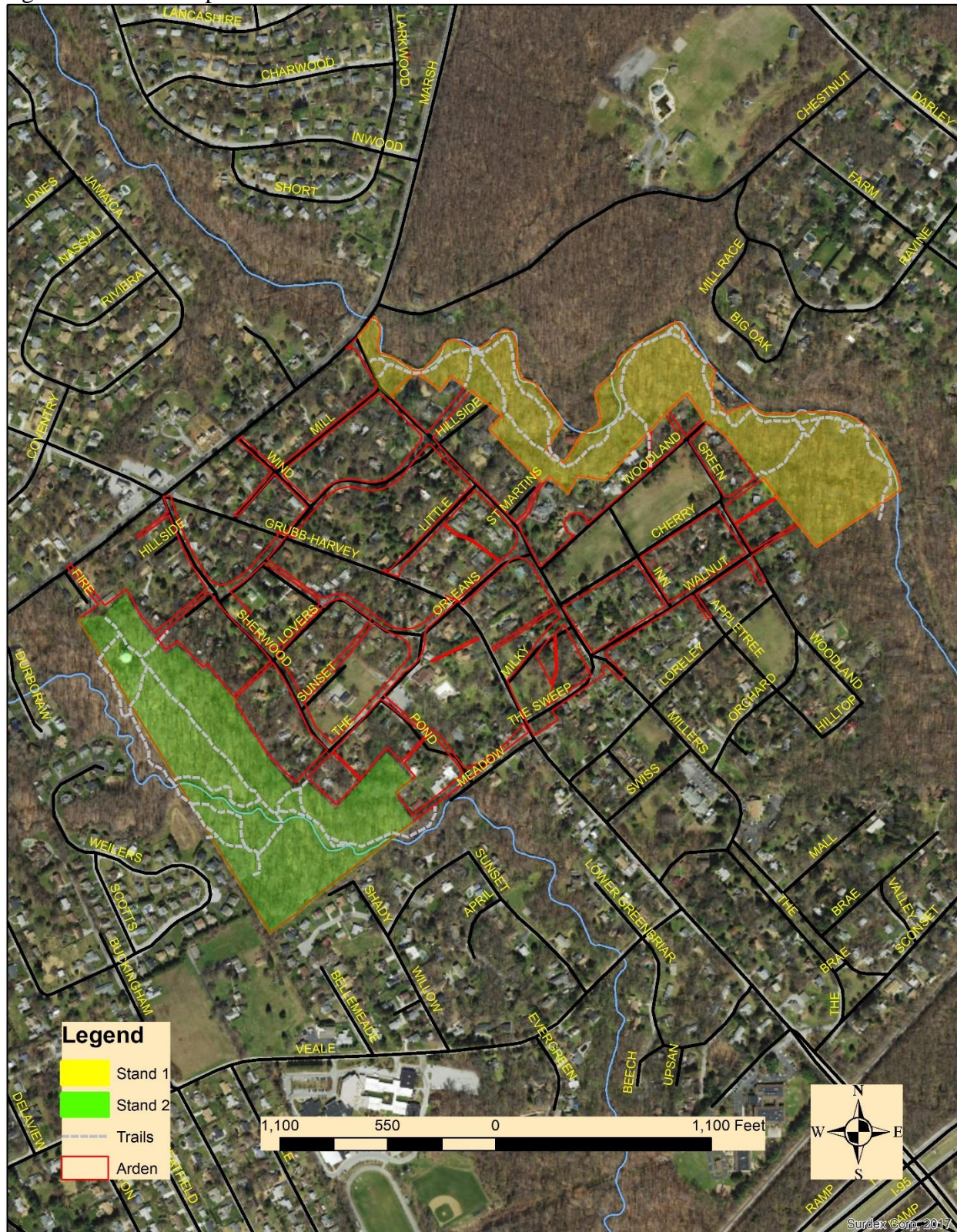




Figure 2. – Plot boardfoot volume map

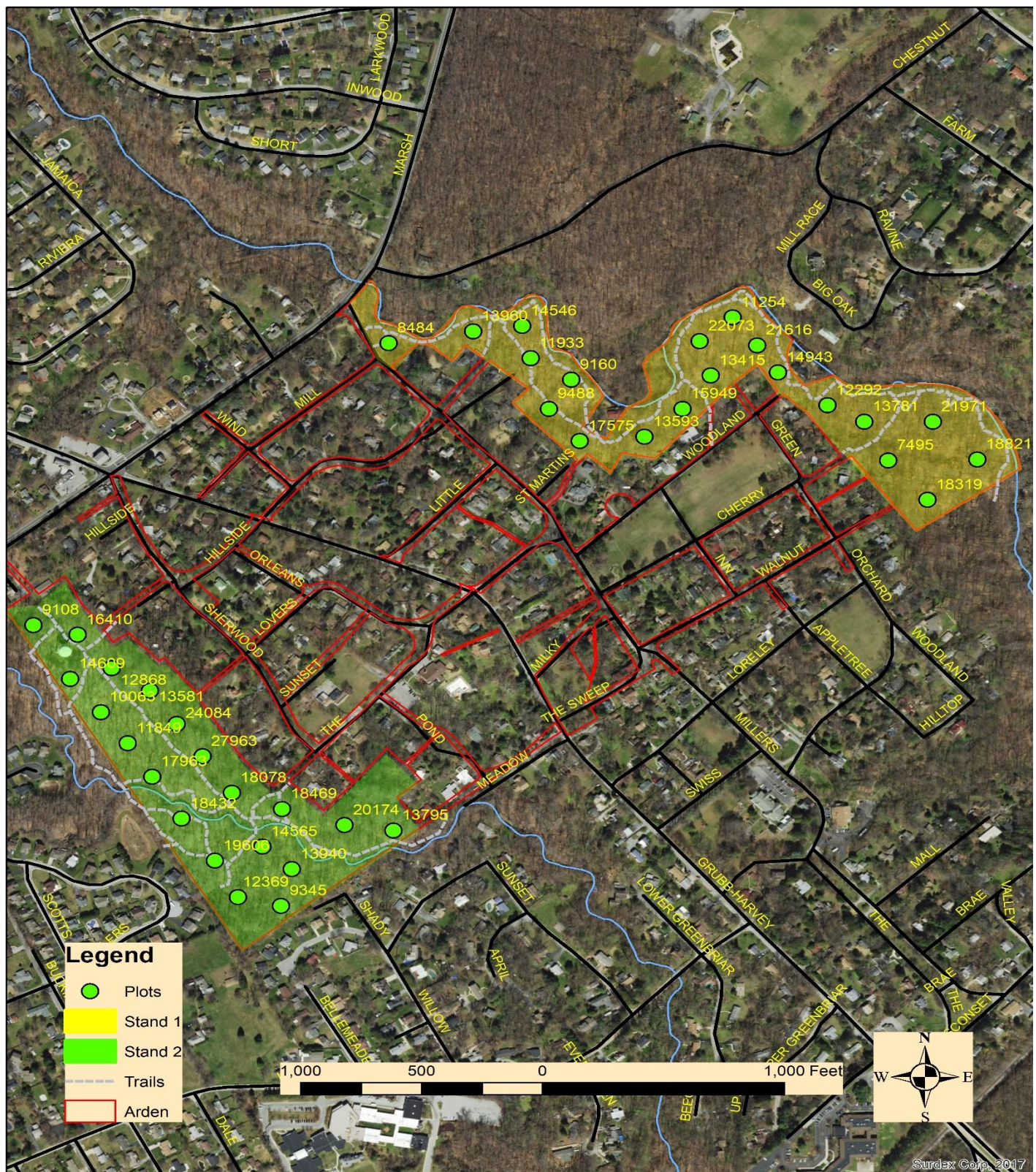
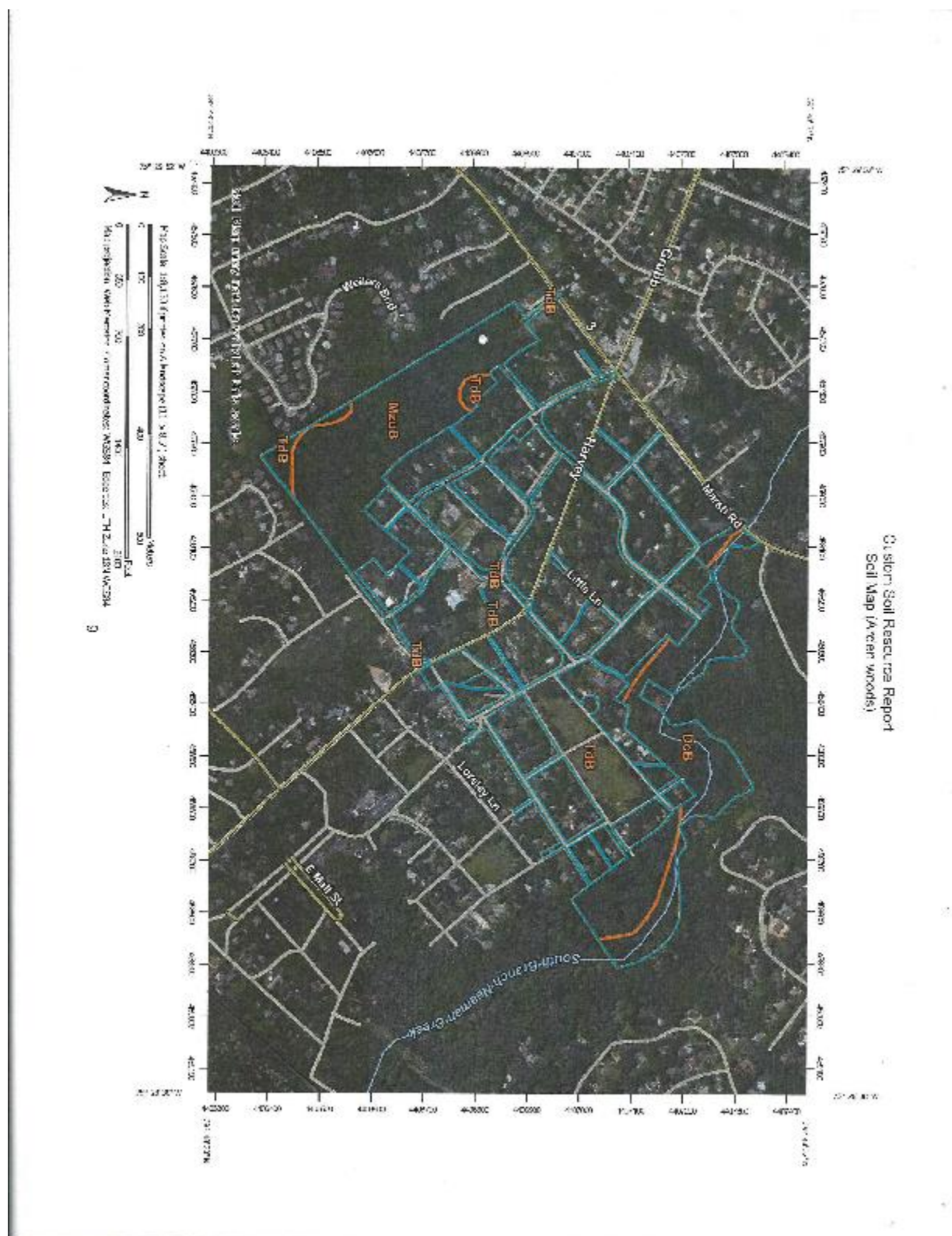




Figure 3. -- Soils map for the Arden property.



## APPENDIX B – Invasive species

**Common Name:** Japanese Grass or Eulalia

**Scientific Name:** *Microstegium vimineum* (Trin.) A. Camus.

*Microstegium* is an annual colonial grass that spreads rapidly into disturbed lowland areas. Inconspicuous at first, populations may go unnoticed until they have displaced native communities. It is a C-4 shade tolerant plant that can survive and reproduce under a closed forest canopy.

**Height:** *Microstegium* is a decumbent and branched annual grass reaching a height of 60-100 cm (24-39 in).

**Stem:** Culms are 1.5 m (59 in) long with glabrous nodes and internodes.

**Leaves:** Cauline leaves are alternate, lanceolate, 10 cm (4 in) long, 2-15 mm (0.08-0.6 in) wide, and sparsely pubescent on both surfaces with ciliate margins.

**Flowers:** Racemes are terminal and may be solitary or in a set of two or three. Spikelets are in pairs, one sessile and one pedicellate, and 4.5-5mm (0.17-0.2 in) long. Blooms August-September.

**Seeds:** Grain is yellow to red, ellipsoid, 2.8-3.0 mm (0.1-0.12 in) long. Seeds mature over a period of about two weeks in September-October.

### Life History

*Microstegium* is an annual C-4 shade tolerant grass in the Poaceae family. It is colonial in nature, rooting from the nodes, and may form dense monotypic stands. Reproduction is exclusively from seed. Each plant may produce from 100-1,000 seeds that remain viable in the soil for five or more years. Seed dispersal is primarily by animals, flooding, and deposition with fill dirt. This plant spreads rapidly into disturbed areas but can invade undisturbed areas by forming satellite populations brought in by animals or flooding. On fertile mesic sites Japanese grass can replace competing ground vegetation within 3-5 years.

*Microstegium* is adapted to low light conditions. At 18% of full sunlight dry matter production is not significantly reduced from production in full sunlight. It will grow and produce seed in light levels as low as 5% of full sunlight.



Photo by Ted Bodner

### Origin and Distribution

Microstegium is native to Japan, Korea, China, Malaysia, and India. It was first identified in the U.S. at Knoxville, Tennessee in 1919, and in 1933 was collected in western North Carolina. By 1964, the grass had spread to 35 counties in North Carolina. By 1972, it had been identified in 14 eastern states, and in 1978, it was collected in Arkansas. Microstegium can be found throughout the state of Tennessee, primarily in previously disturbed mesic areas.



Photo by Ted Bodner

### Similar Species

Microstegium may be confused with cutgrass (*Leersia virginica* Willd.) or knotweed (*Polygonum persicaria* L.). Cutgrass has distinctly longer leaves (1.5 dm [6.0 in]) and shorter spikelets (2.5-3 cm [1.0-1.2 in]) than microstegium. Knotweed is distinguished from microstegium by pale to dark pink calyx and glossy black nutlets.



Photo by James H. Miller

### Habitat

Alluvial soil found in flood plains and stream sides is ideal habitat for microstegium. Other typical habitats include damp fields, lawns, mesic woodland edges, roadsides, and ditches. It is commonly found in areas of natural (e.g., flood scouring) or artificial (e.g., mowing, tilling) disturbance, but can invade undisturbed areas. Microstegium has been observed growing at an elevation of 1,200 m (3,840 ft), but typically is not found on upland sites. Deer avoid microstegium, which allows it a competitive advantage in over browsed areas.

## Management Recommendations

### Mechanical Control

Mow plants as close to the ground as possible using a weed eater or similar grass cutting tool. Treatments should be made when plants are in flower and before seeds are produced. Treatments made earlier may result in plants producing new seed heads in the axils of lower leaves.

### Herbicidal Control

Herbicide treatments should be made late in the growing season but, before the plants set seed. Treatments made earlier in the growing season may allow a second cohort of plants to produce seeds.

**Glyphosate:** Apply a 2% solution of glyphosate and water plus a 0.5% non-ionic surfactant to thoroughly wet all foliage. Do not spray to the point of runoff. Ambient air temperature should be above 65°F to ensure translocation of the herbicide to the roots. Do not apply if rainfall is expected within two hours following application.



Sethoxydin: Apply a 1.5% solution of sethoxydin and water plus a 1% nonphytotoxic vegetable-based oil to all foliage on a spray-to-wet basis. Do not spray to the point of runoff. Ambient air temperature should be above 65°F. Do not apply if rainfall is expected within one hour following application.

**Common Name:** Japanese Barberry

**Scientific Name:** *Berberis thunbergii* DC.

Japanese barberry poses a significant threat to natural areas due to its popularity as a landscape shrub, ability to tolerate full shade, and the dispersal of its prolific seeds by birds. It belongs to the Berberidaceae (Barberry) family, which is represented by one genus in our area.

**Height:** This multi-branched dense shrub grows to 2.5 m (8.2 ft). Seedlings may grow 2-4 ft in one season.

**Leaves:** The semi-evergreen leaves are alternate, or grow in alternate clusters. They are entire, and 1-3 cm (0.4-1.2 in) long. Leaves are bright green to burgundy, and wedge-shaped at the base.

**Stems:** Twigs are brown, three-ridged downward from the node, with simple thorns. Inner bark and wood are yellow.

**Flowers:** Flowers are solitary or in umbel-like clusters, corolla yellow, 8-10 mm (0.3-0.4 in) broad. Blooms March-April.

**Fruits:** Berries are red, ellipsoid to globular, 8-10 mm (0.3-0.4 in) long, and often present through winter. Fruit matures May-September.

### Life History

Japanese barberry reproduces from prolific seeds, rhizomes, or layering. Seeds have a germination rate as high as 90%, and are distributed by birds including ruffed grouse, bobwhite, pheasant, and wild turkey. Because barberry is shade tolerant, an extensive population can become established in a short time under a closed forest canopy. Severe drought or extreme winters have little effect on overall mortality or seed production. Deer avoid barberry while often browsing surrounding vegetation, which may effectively increase barberry's competitive advantage.



Photo by Jil M. Swearingen

## **Origin and Distribution**

Barberry was introduced to the United States in 1864 as an ornamental. It is prevalent in the northeastern states, but can be found from Nova Scotia and Michigan to North Carolina, Missouri, and throughout Tennessee. It continues to be a popular landscape plant with several varieties sold to the public.

## **Similar Species**

Japanese barberry resembles American barberry (*Berberis canadensis* P. Mill.), which grows in dry woods or bluffs. Distinguishing features are the sharply toothed leaves and three pronged spines of American barberry. In most habitats, Japanese barberry is easily recognizable because of its distinctive coloration.

## **Habitat**

Barberry tolerates a variety of habitats from damp lowlands to dry roadsides and waste places. Populations do not expand rapidly into oak-dominant forests or on extreme north-facing slopes. Because it is widely dispersed by the nursery industry, barberry has the potential to impact most natural area ecosystems throughout Tennessee.

## **Management Recommendations**

### **Mechanical Controls**

**Hand Pull:** This method of control is effective for small populations of Japanese barberry, since plants pull up easily in most forested habitats. Hand-pulling is an extremely effective method of reducing population and seed productivity; this can be done during most of the year. Barberry is especially easy to see in the winter and early spring before deciduous plants leaf out. If plants have fruit present, they should be bagged and disposed of to prevent seed dispersal. Care should be taken to minimize soil disturbance.

**Mowing/Cutting:** This method is appropriate for initial small populations or environmentally sensitive areas where herbicides cannot be used. Repeated mowing or cutting will control the spread of Japanese barberry but will not eradicate it. Stems should be cut at least once per growing season as close to ground level as possible. Hand-cutting of established clumps is difficult and time consuming due to the long arching stems and prolific thorns.

### **Herbicidal Controls**

**Foliar Spray Method:** This method should be considered for large thickets of barberry where risk to non-target species is minimal. Air temperature should be above 65°F to ensure absorption of herbicides.

**Glyphosate:** Apply a 2% solution of glyphosate and water plus a 0.5% non-ionic surfactant to thoroughly wet all leaves. Use a low pressure and coarse spray pattern to reduce spray drift

damage to non-target species. Glyphosate is a non-selective systemic herbicide that may kill non-target partially-sprayed plants.

Triclopyr: Apply a 2% solution of triclopyr and water plus a 0.5% non-ionic surfactant to thoroughly wet all leaves. Use a low pressure and coarse spray pattern to reduce spray drift damage to non-target species. Triclopyr is a selective herbicide for broadleaf species. In areas where desirable grasses are growing under or around Japanese barberry, triclopyr can be used without non-target damage.

Cut Stump Method: This control method should be considered when treating individual bushes or where the presence of desirable species precludes foliar application. Stump treatments can be used as long as the ground is not frozen.

Glyphosate: Horizontally cut barberry stems at or near ground level. Immediately apply a 25% solution of glyphosate and water to the cut stump, covering the outer 20% of the stump.

Triclopyr: Horizontally cut barberry stems at or near ground level. Immediately apply a 25% solution of triclopyr and water to the cut stump, covering the outer 20% of the stump.

## Japanese Honeysuckle

*Lonicera japonica* Thunb.

Honeysuckle family (Caprifoliaceae)



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### NATIVE RANGE

Japan and Korea

### DESCRIPTION

Japanese honeysuckle is a perennial vine that climbs by twisting its stems around vertical structures, including limbs and trunks of shrubs and small trees. Leaves are oblong to oval, sometimes lobed, have short stalks, and occur in pairs along the stem. In southern and mid-Atlantic states, Japanese honeysuckle often remains evergreen – its leaves remain attached through the winter. In colder northern climates, the leaves may fall off after exposure to prolonged winter temperatures. Flowers are tubular, with five fused petals, white to pink, turning yellow with age, very fragrant, and occur in pairs

along the stem at leaf junctures. Stems and leaves are sometimes covered with fine, soft hairs. Japanese honeysuckle blooms from late April through July and sometimes into October. Small black fruits are produced in autumn, each containing 2-3 oval to oblong, dark brown seeds about 1/4 inch across.

### ECOLOGICAL THREAT

In North America, Japanese honeysuckle has few natural enemies which allows it to spread widely and out-compete native plant species. Its evergreen to semi-evergreen nature gives it an added advantage over native species in many areas. Shrubs and young trees can be killed by girdling when vines twist tightly around stems and trunks, cutting off the flow of water through the plant. Dense growths of honeysuckle covering vegetation can gradually kill plants by blocking sunlight from reaching their leaves. Vigorous root competition also helps Japanese honeysuckle spread and displace neighboring native vegetation.



### DISTRIBUTION IN THE UNITED STATES

Japanese honeysuckle occurs across the southern U.S. from California to New England and the Great Lakes region. Escaped populations also occur in Hawaii. Severe winter temperatures and low precipitation may limit its distribution in northern latitudes and in the West, respectively.

### HABITAT IN THE UNITED STATES

A ubiquitous invader, Japanese honeysuckle thrives in a wide variety of habitats including fields, forests, wetlands, barrens, and all types of disturbed lands.

### BACKGROUND

Japanese honeysuckle was introduced to the U.S. in the early to mid-1800's as an ornamental

plant, for erosion control, and for wildlife forage and cover. Its highly fragrant flowers provide a tiny drop of honey-flavored nectar enjoyed by children.

## **BIOLOGY & SPREAD**

Growth and spread of Japanese honeysuckle is through vegetative (plant growth) and sexual (seed) means. It produces long vegetative runners that develop roots where stem and leaf junctions (nodes) come in contact with moist soil. Underground stems (rhizomes) help to establish and spread the plant locally. Long distance dispersal is by birds and other wildlife that readily consume the fruits and defecate the seeds at various distances from the parent plant.

## **MANAGEMENT OPTIONS**

Several effective methods of control are available for Japanese honeysuckle, including chemical and non-chemical, depending on the extent of the infestation and available time and labor.

### ***Manual and Mechanical***

For small patches, repeated pulling of entire vines and root systems may be effective. Hand pull seedlings and young plants when the soil is moist, holding low on the stem to remove the whole plant along with its roots. Monitor frequently and remove any new plants. Cut and remove twining vines to prevent them from girdling and killing shrubs and other plants. An effective method for removal of patches of honeysuckle covering the ground is to lift up and hold a portion of the vine mass with a rake and have a chain saw operator cut the stems low to the ground. Mowing large patches of honeysuckle may be useful if repeated regularly but is most effective when combined with herbicide application (see below). Mow at twice a year, first in mid-July and again in mid-September. Plants can also be grubbed out using a pulaski or similar digging tool, taking care to remove all roots and runners. Burning removes above ground vegetation but does not kill the underground rhizomes, which will continue to sprout. In certain situations, tethered goats have been used to remove honeysuckle growth, but must be monitored to prevent their escape to the wild where they would become an added ecological threat.

### ***Chemical***

In moderate cold climates, Japanese honeysuckle leaves continue to photosynthesize long after most other plants have lost their leaves. This allows for application of herbicides when many native species are dormant. However, for effective control with herbicides, healthy green leaves must be present at application time and temperatures must be sufficient for plant activity. Several systemic herbicides (e.g., glyphosate and triclopyr) move through the plant to the roots when applied to the leaves or stems and have been used effectively on Japanese honeysuckle.

Following label guidelines, apply a 2.5% rate of glyphosate (e.g., Rodeo® for wetlands; Roundup® for uplands) mixed with water and an appropriate surfactant, to foliage from spring through fall.

Alternatively, apply a 2% concentration of triclopyr (e.g., Garlon 3A) plus water to foliage, thoroughly wetting the leaves but not to the point of drip-off. A coarse, low-pressure spray should be used. Repeat applications may be needed. Treatment in the fall, when many non-target plants are going dormant, is best. Also, a 25% glyphosate or triclopyr solution mixed with water can be applied to cut stem surfaces any time of year as long as the ground is not frozen.

### ***Biological***

No biological control agents are currently available for Japanese honeysuckle

## **Garlic Mustard**

*Alliaria petiolata*

### **DESCRIPTION:**

Garlic mustard is a biennial herb that emits a garlic-like odor from crushed leaves. In the first year, a rosette of kidney-shaped leaves hug the ground and remain green throughout the winter. Sharply-toothed, triangular leaves form on the 2-4 foot tall flower stem during the second year. White flowers with four petals bloom in clusters at the end of the stem from late April to mid June. The fruit is a long, green capsule that turns brown as the seeds mature. As the plant dies, the long, brown seed capsules at the end of a long naked stem split and release hundreds of seeds.

Garlic mustard was introduced from Europe for herbal and medicinal purposes. In 1868, it was first recorded in Long Island, New York. It is recorded from nearly every county in Ohio.

### **HABITAT:**

Garlic mustard prefers some shade in mesic upland and floodplain forests, savannas, pastures, lawns, and along fencerows and roadsides. It invades forest edges and progresses into the interior along streams and trails.

### **INVASIVE CHARACTERISTICS:**

In forests and woodlands, garlic mustard reduces growth of wildflowers in the early spring before canopy leaf out, and suppresses soil fungi that are mutualistic with trees. It produces large quantities of seeds that can remain viable for up to 10 years. Seeds are dispersed by water or transported by animals and humans.

### **CONTROL:**

**Mechanical:** Hand-pulling is effective in small infestations. Care must be taken to insure that the entire plant, including the root system, is removed and all plant materials are bagged and taken off-site. The plant can continue to mature and produce seeds even after it has been pulled. Control should continue until the seed bank is exhausted (at least 7 years). Cutting stems when flowering can be effective in larger populations. The stems should be cut low to ensure that flowering is hampered. Cutting during flowering generally results in total mortality of the plant. However, seed heads will continue to mature and disperse seeds, so plants should either be cut into pieces or all cut materials should be removed from the site. Control in the spring, targeting first-year rosettes and second-year plants before they flower, is generally more effective than fall treatment of only first-year rosettes. Prescribed fire in late spring can be effective in large populations, particularly if conducted for several years.

**Chemical:** Foliar application of systemic herbicides, such as Roundup, Glypro, or AquaNeat, is effective, even in winter (to kill overwintering rosettes), as long as the temperature is at least 50 degrees F and the area remains dry for eight hours. Extreme care must be taken not to apply the herbicide on desirable plants as these products are non-selective. Herbicide application to the first-year rosettes in the late fall, winter, and early spring will minimize impacts to non-target species while they are dormant. It is crucial to spray all plants within the control area, otherwise the survivors will respond with greater growth and reproduction. If carried out in late fall or winter, it is essential to kill all rosettes in the treated areas, otherwise the survivors will grow large in the absence of competition and seed production will not be lower than in untreated areas. Spray shields may also be used to better direct herbicide and limit non-intentional drift.

## **Wineberry**

*Rubus phoenicolasius* Maxim. **Wineberry**

*Rubus phoenicolasius* Maxim.

Rose family (Rosaceae)



**Origin:** Japan, Korea and China

### ***Background***

Wineberry, or wine raspberry, is a spiny shrub that was introduced into the United States in 1890 as breeding stock for new *Rubus* (raspberry genus) cultivars and still used today by berry breeders. It is prized for its delicious edible raspberry-like berries that are produced in abundance in summer.

### ***Distribution and Habitat***

Wineberry is found from New England and eastern Canada to North Carolina and west to Michigan and Tennessee. It occurs along forest, field, stream and wetland edges and in open woods, preferring moist habitats.

### ***Ecological Threat***

Wineberry forms dense shady thickets that displace native plants and significantly alter habitat structure.

### ***Description and Biology***

- Plant: multi-stemmed shrub with spiny stems densely covered with reddish, glandular hairs, also on flowering stems and buds.



- Leaves: alternate, divided into three leaflets with toothed margins, terminal leaflet largest; undersides conspicuously white.
- Flowers, fruits and seeds: flowers with five white petals occur in springtime; bright red edible berries produced in early summer.
- Spreads: by seed that is consumed and dispersed by birds and mammals (including humans) and by vegetative means when new plants grow from the tips of canes that touch the ground and new plants sprout from root buds.

### ***Prevention and Control***

Do not plant wineberry. It can be controlled through mechanical means or by treating the canes with a systemic herbicide like glyphosate or triclopyr (see [Control Options](#)).

### ***Native Alternatives***

Native blackberries and non-invading cultivated raspberry would be good alternatives.

## **English Ivy**

*Hedera\_helix* Maxim. **English Ivy**

*Hedera helix* L.

Ginseng gamily (Araliaceae)



***Origin:*** Europe, Western Asia and Northern Africa

### ***Background***

European colonists introduced English ivy as early as 1727. It is widely planted for its evergreen foliage and dependability as a year-round “carefree” groundcover. Although recognized as a



serious weed of natural ecosystems, parks, landscapes and other areas, it continues to be sold and marketed as an ornamental plant in the United States. Vast resources, time and labor are expended attempting to manage infestations on public and private lands.

### ***Distribution and Habitat***

English ivy is found throughout the eastern U.S. and in the West where it occurs from Arizona to Washington State. It flourishes under shady to full sun conditions in soils that are moderately fertile and moist but it is intolerant of drought and salinity. Habitats invaded include forest openings and edges, fields, cliffs, steep slopes, and disturbed areas.

### ***Ecological Threat***

English ivy is an aggressive invader that threatens all vegetation levels of forested and open areas, growing along the ground as well as into the forest canopy. Vines climbing up tree trunks spread out and envelop branches and twigs, blocking sunlight from reaching the host tree's foliage, thereby impeding photosynthesis. An infested tree will exhibit decline for several to many years before it dies. The added weight of vines also makes trees susceptible to blowing over during storms. English ivy has been confirmed as a reservoir for bacterial leaf scorch (*Xylella fastidiosa*), a harmful plant pathogen that affects a wide variety of native and ornamental trees such as elms, oaks and maples.

### ***Description and Biology***

- Plant: evergreen perennial climbing vine that attaches to bark of trees, brickwork and other surfaces by root-like structures that exude a glue-like substance to aid in adherence.
- Leaves: alternate, dark green, waxy, somewhat leathery; extremely variable leaf forms, from unlobed to 3-5 lobed; typically green with whitish veins.
- Flowers, fruits and seeds: flowering occurs in late summer to early fall, typically under full sun conditions; flowers are small, greenish-yellow and occur in globular starburst type inflorescences at tips of flowering stems; fruits are black with a fleshy outer layer and stone-like seeds.
- Spreads: vegetatively by vigorous growth at tip of stems; and by seed which is consumed by birds and dispersed to new areas; fruits contain glycosides that may be mildly toxic and cause some birds to regurgitate them; new plants grow easily from cuttings or stem fragments that make contact with the soil.
- Look-alikes: Irish ivy (*Hedera hibernica*), Persian ivy (*Hedera colchica*), Boston ivy (*Parthenocissus japonicus*) and Virginia creeper (*Parthenocissus quinquefolia*). Poison ivy (*Toxicodendron radicans*) may sometimes be confused with English ivy because of its hairy stems but because it is deciduous, it will lack leaves in the winter. In summer, poison ivy can be distinguished easily by its compound leaves of three leaflets and its clusters of creamy white fruits.

**NOTE:** The leaves and berries of English ivy contain the glycoside hederin which may cause toxicosis if ingested. Symptoms include gastrointestinal upset, diarrhea, hyperactivity, breathing difficulty, coma, fever, polydipsia, dilated pupils, muscular weakness, and lack of coordination.



*James H. Miller, USDA FS*

### ***Prevention and Control***

Do not plant English ivy including invasive cultivars. Individual vines can be pulled by hand when soil is moist. Vines covering the ground can be uprooted and gathered using a heavy-duty rake, then close to the ground with pruning snips, Swedish brush axe or other cutting tool.

Gathered vines can be piled up and allowed to desiccate and rot which will occur quickly, in a matter of days. If needed, material can be bagged and disposed of in normal trash. Vines climbing up trees can be cut a few feet from the ground, for convenience, to kill upper portions and then apply systemic herbicide to lower cut portions. Portions of vines rooted in the ground will remain alive and will need to be treated with herbicide or cut repeatedly until no re-growth occurs. A systemic herbicide like triclopyr (2 to 5% solution) may be applied to foliage or cut stems. Apply in the spring as new growth appears. Waxy leaves repel herbicides. Sprays must be applied in high concentrations and with a spreader-sticker. There are no biological controls currently available for English ivy.

A non-toxic spray that has been used is white vinegar. Spray ivy infestations thoroughly with white vinegar. Take care when spraying the vinegar not to get the spray on wanted vegetation, as vinegar is nonselective and will kill wanted grasses and plants in addition to the ivy. Saturate the ivy as much as possible with the spray. Wait one week, then observe ivy infestations. Dead ivy leaves and vines will appear brown. Remove the dead ivy and dispose of it in a garbage can. If ivy is still green or there are green patches amid dead ivy, spray the ivy once more with the white vinegar. Repeat vinegar applications as necessary until you eradicate all the ivy.

# Forest Health Alert

## Bacterial Leaf Scorch

(*Xylella fastidiosa*)



### What is bacterial leaf scorch (BLS)?

BLS is a disease caused by the bacterium *Xylella fastidiosa*. It affects a number of different trees, particularly the red oaks including northern red, scarlet, black, and pin oaks.

### How does BLS hurt oak trees?

The bacteria reside in the xylem, which are the tissues that conduct water from the soil to the leaves, branches, and other parts of the tree. As the bacteria reproduce, they clog and damage the xylem, reducing the amount of water that can get through. The resulting water shortage can injure and kill living tissues.

### How do oak trees get BLS?

The disease is transmitted by insects such as leafhoppers. The insects feed on the xylem of plants that are already infected with *Xylella fastidiosa* and bacterial cells colonize the insects' mouthparts. When the same insects later feed on healthy trees, the bacteria are introduced into the trees' xylem.

### What are the symptoms of BLS?

In late summer and early fall, leaves show marginal scorching. Specifically, the tip and sometimes the edges of the leaf turn brown, but the bottom of the leaf remains green. Often a yellow band or "halo" will be present between the brown and the green. Typically, the disease will start on one or two branches or one side of the tree. Over the course of several years symptoms will spread throughout the tree and branches will die.

- CONTINUED -

# Bacterial Leaf Scorch

## **What will happen to red oak trees that have BLS?**

At this time, it appears that BLS will eventually kill many trees that show symptoms. Death can take many years.

## **Is there any way to prevent the disease?**

There is no known prevention for BLS.

## **Is there any treatment or cure for the disease?**

Studies involving antibiotic treatments have shown mixed results. Annual injections of oxytetracycline or other antibiotics sometimes appear to cause symptoms to go into remission. However, this is not a cure, and the expensive injections must be repeated each year. Research into other types of treatments is ongoing in Delaware.

## **Where is BLS found in Delaware?**

Surveys conducted by the Delaware Forest Service in 2006 determined that BLS is widespread in urban areas throughout Delaware. In 2007, surveys in rural woodlots found that BLS is common in non-urban forests in all 3 counties.

## **What types of oaks are most affected?**

In urban areas, northern red oak (*Quercus rubra*) and pin oak (*Quercus palustris*) appear most affected. In rural forests, BLS has been found in northern red, southern red, scarlet and black oaks.

## **Should I do anything differently now that we know BLS is common in Delaware's towns and cities?**

Since pin and northern red oaks are most affected in urban areas, planting other trees is a good idea. Willow oak does not appear to be affected by BLS in Delaware at this time. This tree survives fairly well in urban areas and is an attractive street tree, and could be substituted for pin and northern red oaks.

## **What can I do for my established trees?**

Stress causes many problems in trees and worsens other problems. A primary cause of stress in trees is drought. Water your trees in the summer during periods of drought. Preventing injuries and periodically fertilizing based on soil test recommendations can also reduce stress.

## **Is BLS dangerous to people?**

No, people can not get sick from BLS. However, sick trees can be structurally unsound and therefore pose hazards to people and property. Trees with dying limbs should be inspected and pruned periodically by a qualified arborist to ensure that hazardous conditions do not develop.



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## **APPENDIX D**

### **GLOSSARY OF TERMS**

**AGS** - Acceptable growing stock. Trees of good form and structure.

**BASAL AREA** - The area of the cross section of a trees' stem at 4 1/2 feet above the ground, or the breast height, in square feet. Basal area of a forest stand is the sum of the basal area's of the individual trees in the stand. It is usually reported in square feet of BA per acre and is used as a measure of the stand stocking, stand density, and stand volume.

**BMP's** - Common sense techniques and treatments that lessen soil erosion, sedimentation, stream warming, movement of nutrients, and visual quality during or following logging or other land disturbance activities.

**DIAMETER BREAST HEIGHT** - The diameter of a tree at 4 1/2 feet above the ground.

**EVENAGED STAND** - One in which the trees differ in age by no more than 10-20%.

**HARDWOOD** - The wood of broad-leaved trees or the trees themselves. Hardwoods are usually distinguished from softwoods by the presence of vessels in the wood and broad leaves.

**MATURE TREE** - A tree that has reached the age where its growth declines or decay begins to increase. Also, a tree is mature when the benefits begin to decline, as in its ability to produce mast or the value of its wood.

**PRESCRIPTION** - The specific instructions for controlled applications of silvicultural treatments based on information about the stands to which they apply.

**REGENERATION** - The new woody growth that develops either under an existing forest or after the forest stand has been harvested. Natural regeneration originated from seeds, sprouts, or root suckers. Artificial regeneration describes planted seedlings.

**RELATIVE DENSITY** - A measure of the stand density expressed as a proportion of some reference level. The reference level is usually the stand density of the best producing, fully stocked stand for a particular species composition, site and method of treatment.

**RIPARIAN AREA** - The area where the transition between streams, or other bodies of water, and forest vegetation occurs. Riparian areas usually have unique plants, animals, and soil characteristics. The boundaries of riparian areas are not always clearly defined. Riparian areas require special care to protect the quality and habitats of streams.

**SEED TREE CUT** - Harvest in which the area is clear-cut except for certain trees high quality trees (seed trees) left standing for the purpose of furnishing seed to restock the cleared area.

## **GLOSSARY OF TERMS cont.**

**SELECTION CUT** - Harvest in which individual trees or groups of trees are removed from the forest. This type of cut maintains a mature forest appearance, and favor shade tolerant species. These cuttings are repeated indefinitely for the purpose of creating or maintaining an unevenaged stand.

**SILVICULTURE** - The art, science and practice of establishing, tending, and reproducing forest stands with desired characteristics.

**SILVICULTURAL TREATMENT** - A process or action that can be applied in a controlled manor according to the requirements of a prescription or plan to a forest community to improve real or potential benefits.

**STAND** - A contiguous group of trees sufficiently uniform in species composition, arrangement of age classes and condition to be a distinguishable unit.

**STAND DENSITY** - A quantitative measure of the proportion of the area in a stand actually occupied by trees. This is an absolute measure rather than a relative measure or percentage.

**STAND STOCKING** - A subjective indication of the number of trees present compared to the optimum number for your desired outcome expressed as a percentage.

**STEWARDSHIP** - The wise management and use of forest resources to insure their health and productivity for future generations.

**TSI** - Timber stand improvement involves the selective removal of some vegetation to allow the expansion of the crowns and root systems of remaining plants.

**THINNING** - Cutting made in an immature stand to stimulate the growth of the trees that remain and to increase the total yield of useful material from the stand.

**UGS** - Unacceptable growing stock. Trees of poor form and structure.

**UNEVENAGED STAND** - One in which there is considerable difference in the age of the trees. Usually the trees are grouped into three or more distinct age classes.

**WETLAND** - In the absence of a single, universally recognized definition, a wetland is a land/water ecosystem characterized by periodic flooding. The soils developed under the influence of saturation. It supports plants and animals adapted to these conditions.

## **APPENDIX E**

### **FOREST MANAGEMENT HARVEST RECOMMENDATIONS**

#### **HARVESTING TREES**

If in the future you consider a timber sale, it is recommended that the trees to be cut be marked by a professional forester and that a sales agreement be prepared to assure the use of good logging practices. A preliminary cruise of the standing timber has been made along with an estimate of the existing timber volume on the property. (See overstory summaries) Stand quality will be improved by the increased growth, and by the removal of the undesirable species and trees of poor form or quality.

#### **HARVESTING NEAR STREAMS, WETLANDS OR RIPARIAN ZONES**

Any harvesting operations or other forest management activities, including road building, that occur in or near streams, wetlands or riparian zones should be conducted with extreme care.

Streams include those that are permanent (perennial) and wet weather (intermittent) in nature; wetlands are lowlands covered with shallow and sometimes temporary waters and those with a water table near the surface, at least part of the year; and riparian zones are areas of vegetation bordering flows, streams, lakes, ponds, and marshes.

No-cut buffer strips or very light selection cuts should be planned along streams. All tree tops should be pulled away a minimum of 25 feet from perennial and intermittent streams.

Wetland and riparian zones vary markedly in the amount and type of vegetation present. Wetlands can be predominantly forested, occupied by shrubs and grasses or even have emergents or aquatic beds. More than 200 different species of birds, mammals, reptiles and amphibians in the eastern United States depend on wetlands for a habitat, to some extent that depends.

Therefore, no cut or carefully planned minimal selection cuts should be prescribed in and around these areas. At least a fifty-foot buffer zone should be maintained.

All trees felled into these areas, including the tree tops, should be winched from the area. Equipment should not be permitted within 100 feet of these areas.

## **Additional Management Considerations**

### **Delaware Forestry Laws**

**Commercial Forest Plantation Act:** This act provides for a 30-year tax exemption for landowners who are managing their 10 or more acres of woodland for primarily merchantable timber. A forest management plan must be approved by the Delaware State Forest Administrator.

**Forestry Practices Erosion & Sediment Law:** This law is authorized to protect the waters of the State from polluting by sediment deposits resulting from silvicultural activities occurring on a land area greater than or equal to one acre. State forest offices must be notified in writing at least ten working days prior to the initiation of silvicultural operations. Best Management Practices (BMPs) must be implemented.



**APPENDIX K**  
**TIMBER SALE CONTRACT CHECKLIST FOR FOREST LANDOWNERS**

Description of the harvest site guaranteed by landowner

- A. Surveyed property lines (possible legal description)
- B. Property lines verified with neighboring boundaries
- C. Cutting boundaries designated with margin of safety when near property boundaries
- D. Clearly designed cutting boundaries with-in the land holding

Description of the timber to be sold

- A. By diameter limit cut
- B. By marked tree designation (single tree selection, crop tree release, etc.)
- C. By merchantable timber designation
- D. By species designation
- E. By clear-cut
- F. All require volume estimates (with the appropriate scale specified in each case)

Protect the property Note: Have the logger register the logging operation with the Delaware FS.

- A. Off-site water pollution restrictions
- B. Soil protection
- C. Waterways protective measures (specify use of BMP=s)
- D. Residual tree damage restrictions
- E. Structures to protect (fences, bridges, culverts, etc.)
- F. Reclamation of critical area requirements
- G. Removal of trash provision
- H. Logger obligations for fire prevention, suppression, and damages

Minimizing the damage

- A. Road planning requirements
- B. Equipment specifications and restrictions
- C. Subletting of contract restrictions
- D. Wet weather operating restrictions
- E. Landowner approval restrictions for roads, skid trails, and log landing locations
- F. Penalty clauses for excessive damage to residual timber stand

### Retiring the road system

- A. Provisions for water diversion structures
  - 1. Requirements for road mats on skid trails and roads, in wet areas
  - 2. Requirements for roadside ditching
  - 3. Providing for culverts and bridges at stream crossings
- B. Requirements for final grading of road
- C. Requirements for lime, fertilizer, seed and mulch where required

### Ownership, handling, and disposal of wood waste

- A. State the ownership of tree tops and slash during contract period
- B. Provide for disposal of wood waste following harvest
- C. Provisions for cleanup of log landings

### Providing for good business practices

- A. State the time allowed for removal of timber (term of contract and provisions for extensions)
- B. State the amount, method, and time of payment
- C. Provide for liability responsibilities in case of accidents
- D. State proper names and signatures
- E. Provide for penalties for cutting of unmarked trees
- F. Make special provisions for building sawmills and other facilities on premises
- G. Provide a statement of how the buyer will have access to the property (ingress and egress)
- H. Provide for methods of making additions or changes in contract (require approval of both parties)
- I. Provide for third party designations to settle contract disputes

## **APPENDIX L**

### **PREPARING TO SELL FOREST PRODUCTS**

Before you sell the timber:

- a. Know your boundaries.
- b. Contact professional foresters for a timber cruise and a plan.
- c. Learn what you have in the way of species, quality, volume, limitations, and accessibility.

Obtain information regarding markets:

- a. Who is buying timber?
- b. What are some of the prices being paid?

The timber sale involves development of a prospectus which includes:

- a. Description of timber for sale.
- b. Show-me date.
- c. Bid opening date.
- d. Outline of some pertinent contract provisions.

The contract should include:

- a. Legal description.
- b. Timber for sale description.
- c. Method of payment.
- d. Length of contract.
- e. Special provisions for damage, road developments, restrictions, etc.

The harvest involves:

- a. Planning the job with the logging contractor to locate:
  1. Timber concentration.
  2. Haul roads.
  3. Landings and skid trails.
  4. Maintaining buffers.
  5. Planning for water control structures.
  6. Determining development of permanent vs. temporary roads.

Monitoring the active logging job involves:

- a. Watching for contract compliance.
- b. Checking on damages.
- c. Maintenance of water control structures.

Ending the harvest includes:

- a. Smoothing skid roads.
- b. Smoothing and draining landings.
- c. Smoothing and draining haul roads.
- d. Cleaning or removing water control structures.
- e. Seeding disturbed areas.

A properly planned timber harvest can result in immediate financial returns along with future benefits such as a more productive woodland, better wildlife habitat, increased property values due to increased accessibility, improved recreational potential for hiking and hunting, and the ability to better protect your woodland from fire, insects and disease.